Interprofessional Communication Goes Up When the Electronic Health Record Goes Down

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OBJECTIVE: The electronic health record (EHR) has been faulted for the erosion of interprofessional communication and the patient-physician relationship. Surgical residents may be susceptible to communication workarounds facilitated by the EHR, but the full extent is not well understood. A recent ransomware attack with the abrupt return to paper charting provided a unique opportunity to investigate the impact of the EHR on surgical residents' interprofessional communication. We sought to explore how surgical residents perceived communications during the 2-month period when the EHR was inaccessible.

DESIGN: General surgery residents who rotated through the regional tertiary referral medical center and level I trauma center were invited to participate in a semistructured interview about communication with one another, faculty, staff, and patients during the downtime. A grounded theory approach was used to analyze the data.

SETTING: Regional tertiary referral medical center and level I trauma center.

PARTICIPANTS: General surgery residents who rotated through the affected site.

RESULTS: Ten general surgery residents were interviewed. Interviews revealed that the abrupt loss of the EHR impacted communication in three major ways: (1) engendered more professional courtesy and collegiality, (2) prioritized bedside patient care over documentation demands, and (3) encouraged more explicit and deliberate communications.

CONCLUSIONS: Our study demonstrates that the loss of the EHR encourages surgery residents interprofessional communication. With healthcare becoming increasingly digital, active efforts should be made to preserve the communication benefits by optimizing existing and emerging technology to facilitate direct face-to-face interactions. (J Surg Ed 76:512–518. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Electronic health record, Surgical education, Communication

ABBREVIATIONS: EHR electronic health record, ACS American College of Surgeons, IT information technology, PGY postgraduate year, IME Indirect Medical Education

COMPETENCIES: Systems-Based Practice, Interpersonal and Communication Skills, Professionalism, Patient Care

INTRODUCTION

The electronic health record (EHR) has been faulted for the erosion of interprofessional communication and the patient-physician relationship.[1,2] The EHR was intended to increase interprofessional collaboration and care coordination but has instead facilitated the development of silos within healthcare.[3] At the residency level, interns spend 40% of their time on the EHR and only 12% in direct patient care, with some interactions performed via the telephone to call inpatients on their service to inform them of test results of upcoming procedures instead of walking to patient rooms.[4,5] Surgical residents may be more susceptible to communication workarounds facilitated by the EHR, since the high-stakes, fast-paced perioperative environment and rigorous operating schedule frequently necessitate decisions to be made as quickly as possible. However, it is not clear whether the loss of EHR would negatively

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impact the surgical residents' communication with one another, faculty, staff, and patients.

A recent ransomware attack at our University teaching hospital necessitated the shutdown of our EHR for 2 months. As the tertiary referral center and the only level I trauma hospital in the region, the hospital continued to offer a full spectrum of clinical services and to operate at full patient capacity. The sudden omission of the EHR, and abrupt return to paper charting, provided a unique opportunity to investigate the impact of the EHR on surgical residents' interprofessional communication. We sought to explore how surgical residents communicated with one another, faculty, staff, and patients in the time period during which the EHR was inaccessible. This project holds promise as a resource for surgical residents and faculty attending surgeons in understanding how the EHR has shaped our ability to communicate.

MATERIALS AND METHODS

The institutional review board of the University at Buffalo reviewed and approved the study protocol with waiver of informed consent (STUDY00001275). The study was designed and conducted by authors with dedicated postdoctoral training and publications in quantitative, qualitative, and mixed methods research. General surgery residents who rotated at the ACS-verified adult level 1 trauma hospital at the time of the ransomware attack and the ensuing 2 months were invited to participate in a semistructured interview regarding their downtime experience on the topics of patient care, clinical workflow, and communication. We were in control of the process of obtaining information from the general surgery residents interviewed but were free to follow new leads as they arose. Interviews took place over a 2-week period at a single academic medical center. New interviewees were sought until information gathered from interviews no longer expanded or refined the preliminary data or once all general surgery residents from a particular postgraduate year (PGY) level who had rotated at the affected site had been interviewed. Efforts were made to achieve maximum variation with respect to PGY group representation to increase the likelihood that the varying perspectives would accurately represent differences and reduce the potential of having a biased sample.[6] Each interview was conducted in a confidential manner and transcribed verbatim without any identifying information by a single interviewer (JZ) who was not involved with clinical responsibilities at the time of the ransomware attack. All authors had access to and reviewed the interview transcripts.

The transcribed interview data were analyzed via a grounded theory approach, a qualitative methodology that is differentiated from quantitative research as hypothesis *generating* rather than hypothesis *testing*.[7] Briefly, as part of this qualitative methodology, semistructured interviewing tactics were used to gain subject matter depth and cultivate insight into meaning interviewees made of phenomena within their social context. Interview transcripts were analyzed in detail and interpreted individually and in the context of all available transcripts. Cogent themes were identified and coded via a process involving open, axial, and selective coding. The emergence of themes from this inductive process came specifically from information elicited by the interviewees and was developed based on iterative, rigorous, and systematic examinations of interview data.[8] Disagreements in code assignment between JZ and EK were resolved by discussion until consensus was reached at each step, establishing credibility and groundedness in the data.[9] We made sure to keep a catalog of memos, audit trails, and triangulations methods to ensure that our final interpretation of the results were credible, transferable, dependable, and confirmable.

RESULTS

Ten general surgery residents were interviewed (Table 1). All had rotated at the affected trauma hospital when the EHR was unavailable. Seventy percent of the residents interviewed were men (for context, the general surgery residency complement for the 2016-2017 academic year was 63.9% men). All interviewees contributed to the emergent themes identified by the investigators.

Interviews revealed that the abrupt loss of the EHR impacted communication in three major ways detailed as follows.

TABLE 1. Demographics of Surveyed Residents for the Academic Year 2016-2017

Postgraduate Year	***n* (%)**
1	2 (20)
2	3 (30)
3	2 (20)
4	1 (10)
5	2 (20)
Gender	
Male	7 (70)
Female	3 (30)

TABLE 2. Grounded Theory Analysis of Interview Transcripts Revealed that the Loss of the Electronic Health Record Engendered More Professional Courtesy and Collegiality. The Deidentified Surgery Resident and Corresponding Postgraduate Year (PGY) Level Responsible for the Representative Quote Supporting Each Theme is Noted in Parentheses

Theme I. The Downtime Engendered More Professional Courtesy and Collegiality Support for Theme	Representative Quote(s)
Daily plans became a joint collaboration between doctors and nurses	"Nurses saw me more in person because I had to physically stay by the chart to write my notes. This provided an opportunity for nurses to ask me questions and we could come up with a joint plan." (R2-PGY3)
Existing surgical teams became more cohesive	"Medical students became integral to the team." (R1-PGY1) "There was more teaching and training together because you saw your chief residents and attendings more." (R2-PGY3)
Extra efforts were made to communicate between services	"[The downtime] got people off their butts to go see the patients, talk to the nurse, talk to the providers, versus sitting in a cold dark room staring at a screen." (R10-PGY3)

Theme I. Increase in Professional Courtesy and Collegiality

The loss of the EHR meant that general surgery residents were more likely to be on the floor to write notes, resulting in increased interactions with nurses and case managers. The increase in face-to-face contact with nonphysician staff led to more joint decision-making (Table 2). Plans by general surgery residents were formulated in collaboration with nurses, who felt more comfortable asking questions and reviewing patient management. Furthermore, existing surgical teams were felt to have become more cohesive. Because the workflow was no longer flattened—i.e. the EHR was no longer available as a source for all clinical data—every level of the surgical team stepped up their involvement in patient care, from attending surgeons and senior general surgery residents being more physically present and providing overt supervision, to medical students acting as extensions of the surgical team by making phone calls or acting as runners to various locations within the hospital to collect imaging or laboratory data on behalf of interns or junior residents. General surgery residents noted that they took extra efforts to communicate with residents from other medical services to ensure patient care recommendations were properly conveyed because there was no guarantee that notes written in the paper chart would be read in a timely fashion or not be misplaced. Given concerns over whether or not consultation requests called out by nonphysician staff (e.g., floor clerks) would actually occur, general surgery residents were much more likely to personally communicate them in person or over the phone; this behavior was emulated by residents from other services, and the nature of consultations became much more appropriate in terms of acuity and inpatient necessity.

Theme II. Bedside Patient Care Became a Priority Over Documentation Demands

The loss of the EHR meant that general surgery residents had to physically travel to the nursing station and patient's bedside for updates, since vital signs, intake, and output data, and laboratory and imaging results were not readily accessible from a remote computer station. It meant the patients saw more of the general surgery residents (Table 3). Daily notes were completed much more quickly during the downtime compared to usual because the typical documentation demands for billing and regulatory purposes were temporarily suspended. The decreased documentation demands contributed to the residents' increased availability for bedside patient care. Patients became the primary source of their own narratives, and residents and nurses alike developed much stronger historical knowledge of the patients under their care as a result of the EHR being unavailable to provide the clinical staff with prepopulated problem and medication lists from previous and current hospitalizations.

Theme III. More Explicit and Deliberate Communications were Encouraged

Communication increased all around when the EHR was unavailable. Not all of it was perceived as meaningful or accurate (Table 4). In the first few weeks following the ransomware attack, regular processes took significantly longer to complete; due to the abruptness with which the EHR was shut down and the many unknowns associated with when the EHR would return, residents noted that miscommunications proliferated. For example, leading up to the ransomware attack, all prescriptions were sent and filled

TABLE 3. Grounded Theory Analysis of Interview Transcripts Revealed that the Loss of the Electronic Health Record Led to Fewer Documentation Demands, Which Allowed Bedside Patient Care Become Reprioritized and Resume Control Over Their Own Narratives. The Deidentified Surgery Resident and Corresponding Postgraduate Year (PGY) Level Responsible for the Representative Quote Supporting Each Theme is Noted in Parentheses

Theme II. As Documentation Demands Decreased in the EHR, Patients Became Prioritized and Regained Control Over Their Own Narratives	
Support for Theme	**Representative Quote**
The downtime resulted in more face-to-face time with patients	"You went to see the patient more times in a day than you would have with an EHR. With the EHR down, patient care was patient care. Nurses were better at being nurses. Doctors could just be doctors. We could focus on the patient. Patient care was number one." (R2-PGY3)
Patients regained control over their own narrative with the EHR down	"We rely on prior records to gain a better understanding of our patients and their histories, but the patients are annoyed and frustrated when we don't know information that for them is self-evident but for us would have been self-evident if we had the EHR." (R1-PGY1)

TABLE 4. Grounded Theory Analysis of Interview Transcripts Revealed that the Loss of the Electronic Health Record Led to More Noise Generated and Residents and Faculty to be Much More Explicit and Deliberate in Their Own Communications and to Go Out of Their Way to Double Check Everything. The Deidentified Surgery Resident and Corresponding Postgraduate Year (PGY) Level Responsible for the Representative Quote Supporting Each Theme is Noted in Parentheses

Theme III. A Lot of Noise was Generated During the Downtime, Leading Residents and Faculty to Become More Explicit in Their Own Communications and Double Check Everything	
Support for Theme	**Representative Quotes**
Communication became more deliberate	"With the EHR, you just drop a note, and you can get away with not communicating. With paper notes, you had people being more deliberate about communicating the plan." (R4-PGY5) ". . .talking to the nurses, I became more specific when it came to discussing patient plans for that day." (R6-PGY2)
Trust but verify took on heightened importance	"We relied on nurses and secretaries to put the faxed labs and imaging reports in the right chart, and they often misplaced them or put them in the wrong chart, so that was frustrating." (R1-PGY1) "We don't trust other services so we double check everything, which was a strength that came out during the downtime." (R8-PGY1)
Communications were not always accurate or beneficial	"People would tell me stuff but it would be wrong so I would do the same thing three times. That was a huge waste of time." (R7-PGY2) "My notes were done way quicker, but they pretty much said nothing." (R9-PGY2)

electronically. That capability disappeared when the EHR shut down, but in the initial days following the ransomware attack, the EHR downtime had not become local public knowledge, and many pharmacies refused the paper prescriptions being presented to them by recently discharged patients. Phone calls between members of the surgery team and outside pharmacies were noted as one of many examples of inefficiencies that contributed to the lengthening of the workday at the beginning of the EHR downtime. Furthermore, trust but verify took on heightened importance because there was no guarantee that anything anyone said, however well-intentioned, was true or that a task would be successfully completed in a timely fashion, if at all. As the downtime persisted, workflows became more efficient, as a result of general surgery residents at every PGY

level exercising much more deliberate thought into their clinical decision-making, e.g., whether or not each diagnostic study being ordered was necessary, and making sure to be as explicit as possible when communicating orders, recommendations, and updates both downstream and upstream.

DISCUSSION

We used the opportunity of hospital ransomware attack to study how the EHR, via its sudden absence, has shaped the ability of general surgery residents to communicate. We used a grounded theory approach in our study to comprehensively capture the complexity of the EHR's impact on surgical communication. The use of semistructured interviews provided us with opportunities to delve more deeply into new leads as they arose and to capture certain findings that a purely quantitative analysis may have missed. Grounded theory is a rigorous, systematic methodology that has been well-established in the social sciences.[7,9] We found that the reduced documentation demands of the EHR and the increased difficulty associated with information retrieval encouraged general surgery residents to communicate more frequently and effectively with patients, team members, and other physician and nonphysician staff. Our study is novel in that it is the first to study how the sudden absence of the EHR—and consequent return to paper charting—in the digital era of graduate medical education has affected resident perceptions of surgical interprofessional communication.

Findings from our study reveal that the EHR has promoted service at the expense of a collaborative team culture and professionalism. While the EHR may have facilitated information retrieval and improved legibility, it has failed to bridge existing gaps in care coordination and multidisciplinary interactions.[10,11] Since its widespread implementation, the use of the EHR has expanded to include various data capture requirements for regulatory and research purposes, with the majority of the documentation burden falling to clinical staff.[3] The EHR's scope creep have resulted in unintended consequences that include but are not limited to the amplified practice of defensive medicine, degradation of the patient-physician relationship, and professional isolation, burnout, and attrition.[3,11] Medical and graduate medical education have also been affected.[1,5] Teaching hospitals receive an Indirect Medical Education payment from Medicare for the increased medical costs associated with treating more complex patients and with maintaining standby capacity for catastrophic events.[12] However, many teaching hospitals run tight financial margins and face pressures to meet certain quality and patient satisfaction metrics tied to monetary incentives that they cannot afford to sacrifice, even with the addition of the Indirect Medical Education.[13,14] As a result, residents and fellows often have to adhere to the same rigid EHR documentation demands and care pathways as their faculty supervisors; because of the hassle involved with reviewing medical student notes and orders within the EHR, medical students are not uncommonly excluded entirely from the team dynamic.[14] The lack of medical students in the team, and with the EHR, has negative consequences when they transition into their roles as surgical interns; the multitude of experiences new surgical house staff are expected to master (patient management, in-service examination preparation, hospital system, local politics, and hidden curriculum) and the increased restrictions being imposed, many for their benefit (minimum operative case logging requirements, minimum in-service examination score, duty hour restrictions, and supervision) have been compounded by the addition of fast-paced EHR onboarding in the context of suboptimal EHR training.[15-17] As a consequence, face-to-face bedside interactions with patients are not uncommonly sacrificed in the melee.

Formal research exploring the value of the EHR and whether the time spent by residents on the EHR has negative effects on patient care been scarce.[11] The ransomware attack at our trauma hospital provided us a unique opportunity to add to the literature. Our study supports the small but growing body of work chronicling the negative consequences of the EHR on communication. Prior studies and personal experience have established that use of the EHR decreases patient satisfaction while waiting until the end of the patient encounter to use the EHR increases physician burnout and workload.[11,18] When the EHR became unavailable, barring the initial upsurge of miscommunications, the quality of interactions between general surgery residents and team members and with other professionals and patients substantially improved. Our study revealed that general surgery residents were incentivized to collaborate, to take initiative, and to communicate as clearly and as often as possible to advocate on behalf of their patients when the EHR was inaccessible. Specifically, face-to-face communication with colleagues in other specialties significantly increased and reliance on nurses or clerks to place consultation requests or communicate messages significantly declined.[19] Because residents were in front of computers less and on the wards more, they were more likely to formulate patient care plans with other caregivers, including nurses and discharge planners. Because the EHR was unavailable for residents to readily double check a lab value or a radiological impression, they had to listen much more attentively to patient presentations and consultation requests from others, and

vice versa, residents themselves learned how to be more deliberate with their own communications over the course of the EHR downtime. The behaviors of the general surgery residents during the EHR downtime likely not only prevented serious error in patient care but also improved the ability of the residents to recognize and analyze patient problems, as well as avoid unnecessary diagnostics or delays in adequate treatments.[4,5,20,21]

While unique in scope, this study has its fair share of limitations, one of which is that the study was conducted at a single site. Another is that only a portion of the full general surgery residency complement rotated at the affected trauma hospital when the ransomware attack occurred; therefore, residents' attitudes toward the unavailability of the EHR and its consequent impact on communication may be biased to reflect only the opinions and perceptions of those individuals, especially as they relate to the specific commercial vendor and generation of one particular EHR system. The heterogeneity of graduate medical training level represented in the interviewees may also translate into differences in perceptions and experiences. Our study is also limited by the fact that we only captured the viewpoints of a single group of caregivers—that of general surgery residents—so additional perspectives from other health care staff, nurses, and even patients that may have altered or bolstered our analysis were not included. Furthermore, to maximize anonymity, we did not capture participant characteristics. Although residents were assured of strict confidentiality and had the freedom to decline participation in the interview—which in fact some did—participation and responses may still be subject to social desirability bias. Lastly, interviews were performed once much of the EHR was back online, so a recall bias is always possible.

CONCLUSION

In conclusion, our study demonstrates that the loss of the EHR encourages surgery residents to communicate more frequently and effectively with one another, patients, and other healthcare professionals, including faculty and staff. The EHR creates a slippery slope down which it becomes easy to rationalize a communication shortcut when faced with other pressing patient care issues. These shortcuts were unavailable when the EHR was inaccessible and residents were forced to work on paper. Modern day surgical residents are particularly susceptible to communication workarounds facilitated by the EHR in the setting of the fast-paced, high-stakes perioperative environment because the EHR as it is currently set up does not incentivize interprofessional communication or collaboration. This is apparent now that the EHR has been restored, with consultation requests made once again via unit secretaries and recommendations placed in the patient's electronic chart. With healthcare becoming increasingly digital, active efforts should be made to leverage the EHR to facilitate direct face-to-face interactions and shared patient-centered decision-making among team members from different disciplines. The pendulum has swung from one extreme to another with paper-based documentation and the EHR. Our study highlights the need for those of us in healthcare to champion a better middle ground in which we keep the information accessibility and data tracking capabilities associated with the EHR while seeking to restore the closed loop communication structure incentivized by our historical use of paper-based documentation. The technological capabilities exist. Whatever solutions are implemented will require creativity and collaboration from multiple players within the healthcare system, with the understanding that great technology cannot fix a broken workflow. For example, a good starting point would be the widespread implementation of up-to-date call schedules and easily accessible contact information. As surgeons, we must be better advocates for our patients and for ourselves when it comes to shaping health information technology policy and reducing the documentation burden associated with EHR use.

REFERENCES

1. LoSasso AA, Lamberton CE, Sammon M, et al. Enhancing student empathetic engagement, history-taking, and communication skills during electronic medical record use in patient care. *Acad Med.* 2017;92:1022–1027.
2. Imdieke BH, Martel ML. Integration of medical scribes in the primary care setting: improving satisfaction. *J Ambul Care Manage.* 2017;40:17–25.
3. Arndt BG, Beasley JW, Watkinson MD, et al. Tethered to the EHR: primary care physician workload assessment using EHR event log data and time-motion observations. *Ann Fam Med.* 2017;15:419–426.
4. Gagliardi JP, Turner DA. The electronic health record and education: rethinking optimization. *J Grad Med Educ.* 2016;8:325–327.
5. Terpstra OT, Stegeman JH. Effects of the restriction of working time for residents: a Dutch perspective. *J Grad Med Educ.* 2011;3:462–464.
6. Sargeant J. Qualitative research part II: participants, analysis, and quality assurance. *J Grad Med Educ.* 2012;4:1–3.
7. Sullivan GM, Sargeant J. Qualities of qualitative research: part I. *J Grad Med Educ.* 2011;3:449–452.

8. Cochran A, Elder WB. Effects of disruptive surgeon behavior in the operating room. *Am J Surg.* 2015;209:65–70.

9. Schwarze ML. Qualitative research methods. In: Dimick JB, Greenberg CC, eds. Success in Academic Surgery: Health Services Research, First ed, Editor 2014, Springer-Verlag:217–227.

10. Saini D, Sandhu A, Gori MM, Orthner HF. A study design for comparing electronic patient care report (ePCR) with paper PCR in pre-hospital care. *AMIA Annu Symp Proc.* 2005;2005:1103. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1560695/.

11. Clynch N, Kellett J. Medical documentation: part of the solution, or part of the problem? A narrative review of the literature on the time spent on and value of medical documentation. *Int J Med Inform.* 2015;84:221–228.

12. Weiman DS. Who pays for resident salaries? *Blog.* 2017;2018. Huffington Post. https://www.huffingtonpost.com/darryl-s-weiman-md-jd/who-pays-for-resident-sal_b_12967008.html.

13. Roberts L, Cornell C, Bostrom M, et al. Communication skills training for surgical residents: learning to relate to the needs of older adults. *J Surg Educ.* 2018;75(5):1180−1187. https://www.ncbi.nlm.nih.gov/pubmed/29609892.

14. Fayanju OM, Aggarwal R, Baucom RB, Ferrone CR, Massaro D, Terhune KP. Surgical education and health care reform: defining the role and value of trainees in an evolving medical landscape. *Ann Surg.* 2017;265:459–460.

15. Ban KA, Chung JW, Matulewicz RS, et al. Gender-based differences in surgical residents' perceptions of patient safety, continuity of care, and well-being: an analysis from the flexibility in duty hour requirements for surgical trainees (FIRST) trial. *J Am Coll Surg*. 2017;224:126–136. e122.

16. Matulewicz RS, Odell DD, Chung JW, Ban KA, Yang AD, Bilimoria KY. Association between resident perceptions of patient safety and duty hour violations. *J Am Coll Surg*. 2017;224:113–117. e114.

17. Kreutzer L, Dahlke AR, Love R, et al. Exploring qualitative perspectives on surgical resident training, well-being, and patient care. *J Am Coll Surg*. 2017;224:149–159.

18. Ratanawongsa N, Matta GY, Bohsali FB, Chisolm MS. Reducing misses and near misses related to multitasking on the electronic health record: observational study and qualitative analysis. *JMIR Hum Factors*. 2018;5:e4.

19. Zhao JY, Kessler EG, Yu J, et al. Impact of trauma hospital ransomware attack on surgical residency training. *J Surg Res*. 2018;232:389–397.

20. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med.* 2009;360:491–499.

21. Counihan T, Gary M, Lopez E, Tutela S, Ellrodt G, Glasener R. Surgical multidisciplinary rounds: an effective tool for comprehensive surgical quality improvement. *Am J Med Qual.* 2016;31:31–37.

SUPPLEMENTARY INFORMATION

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